SCIENCE

FRIDAY, JUNE 22, 1888.

A WRITER TO the Contributors' Club of the July *Atlantic* rightly says that much time and thought are spent in selecting a name for a play or novel, for it is known that success is largely dependent on it, but that parents are strangely careless and unscientific in giving names to children. In the Harvard and Yale catalogues of last year the contributor finds but two or three combinations really good in his opinion. Usually, when a new-comer arrives, some old family name is taken; or, if the parents exercise an original choice, they are too much excited to be guided by any sound euphonic principles. They forget that not only from the social point of view it is very advantageous to have one's name remembered, but that from the business point of view notoriety is capital, and must be obtained by persistent and ingenious advertising. But if a certain amount of notoriety could be obtained for John Smith by an expenditure of time, money, and ingenuity represented by x, and spread over a period of three years, the *Atlantic* writer thinks it safe to say that the same amount could be obtained for Hans Arrowsmith by $\frac{x}{4}$ in eighteen months. Nor does he think the saving of time and money on the part of the knocker at the gate of notoriety the only thing to be considered. The economy of the public stock of energy wasted in innumerable unconscious efforts to remember a name without any corners for the memory to grasp, but persistently thrust before it, would result in an increase of available mental force applicable to settling the question of future probation, or to raising the ethical standard, or to reforming the tariff, or to disposing of the surplus. The importance of the subject leads to the suggestion of one or two of what we believe to be the chief fundamental principles of the science of naming children. The system is simple, and any provident parent can easily master and apply it. 1. Avoid odd, or eccentric, or poetic combinations, and be guided by euphonic quality only. It is true that an odd name may be remembered, but the associations with it will not be pleasing. The idea of oddity or affectation may attach to the shadowy personality built up in the mind of the public. Under this rule, hyphenated names, especially hyphenated Christian names, like Floyd-Jones Robinson, are to be avoided. Writing the first given name with an initial and the second in full is also evidently opposed to correct scientific principles. 2. The best form of a name is a dactyl and a spondee, like 'Jeremy Taylor.' Every one has heard of the 'Shakspeare of divines,' and has a dim idea of an agreeable personality attached to the name. Had his name been Charles Taylor, it is far within bounds to say that his reputation would be about one-third of what it is now. 3. If the surname is not one that can be treated according to the above rule, it should be fitted with a given name, such as to bring the combination as nearly as possible to the above length and cadence, as, Sidney Dobell, Ellery Vane, Henry Ward Beecher, Dante Rossetti, Theodore Watts, and the like; or, otherwise, to two long syllables, like Mark Twain or Bret Harte. The subdivisions of this branch of the subject are too numerous to be given, but all rest on principle No. 2. The phonic value of the surname is, under our custom, the controlling element in practically applying the science of names. The great value of names beginning with 'Mac' or 'O' is evident, because they so readily combine with the ordinary Christian names. A boy pervades the *Atlantic* writer's quiet neighborhood simply because his name is Johnny MacWhorter. He is not in any respect a remarkable boy, but his name forces him into prominence by its phonic value. There are some ten or twelve boys who are comrades, but he and another dactyl-spondee boy, Emory Watson, are the only ones ever spoken of. No doubt there are others who do as much mischief and make more noise, but these two reap all the fame.

THE BILL CREATING a department of agriculture has been recommitted in the Senate, the object of those who voted this disposition of it being to have restored the section, which had been stricken out, transferring the Weather Bureau to the proposed new department. What the final vote upon this question will be is still in doubt, as is also its wisdom. The Weather Bureau has become a necessity to the people of the United States, who will cheerfully pay the million dollars that it annually costs, but who will insist, that, if any change in the service is made, it shall be certain to bring about an improvement, and not a deterioration. The provision of the section in question that gives to all present officers of the Signal Service who shall be transferred to the proposed new department a perpetual tenure of office, at their present pay, making no provision for weeding out the worthless men or advancing the competent ones, is certainly not calculated to make the service any better. It would probably result in the permanent retention of the incompetent, dissipated men in the Weather Bureau; while the bright men, who would be really useful in the bureau, would prefer other positions, where they might be promoted as they deserved.

The observations upon which the Weather Bureau bases its calculations are now all made by enlisted men of the army, who have been specially instructed and trained for the work. No political influence whatever has been allowed to operate for their appointment, promotion, or retention in the service. It has been the aim of the chief of the Signal Office to send to all important stations men who will be acceptable to the communities in which they are to live and do their work, but no member of Congress has been able to secure the transfer or removal of an observer sergeant in order that some favorite might be put in his place. The security which the observer sergeants have felt for the terms of their enlistment has certainly had a beneficial effect upon the character of the service they have rendered. It may seem an anomaly to the people that a duty that is in no respect of a military character should be done by soldiers rather than by civilians, but the military organization of the Weather Bureau has certainly resulted in keeping political influence from dictating in regard to the *personnel* of a class of men whose appointment and promotion it was very desirable to keep free from this influence.

A straw was in the wind the other day which shows the direction it has already taken in anticipation of the change. Mr. Hatch, member of Congress from Missouri, and chairman of the Committee on Agriculture, recently recommended that a certain private in the Signal Service be made a lieutenant, and the entire Missouri delegation joined in the request. When the matter was referred to General Greely, he replied that the promotion could not be made. In the first place, it would be illegal to appoint the man to be a lieutenant unless he was already a sergeant, and he could not be made a sergeant because he was incompetent for the duties of that office. If the man had been a civil officer, or the bureau had been attached to a civil department, he would probably have secured his promotion. A new plan to transform the Weather Bureau from a

military to a civil one was disclosed in the sundry civil appropriation bill reported in the House last Saturday. It provides for the appointment of a civil force of 111 persons in the office of the Chief Signal Officer, with an aggregate compensation of $114,500 a year, and this force it is proposed to substitute for the present military one of 150 men, and so save an expense of $70,748 a year.

THE EFFICIENCY OF MECHANICAL ENGINEERING SCHOOLS.[1]

WHEN the alumni of a school of engineering meet in annual reunion and conference, it is but natural to select for discussion a subject the serious deliberation of which will, to some extent at least, advance alike the interests of engineering practice and of the technical school itself. The technical graduate, who loves his profession and his alma mater, must deem it a wish of his heart to further in every way the harmony between the training and the practice of the engineer, to raise the efficiency of both the practice and the school to the highest attainable standard.

Happily, it is a fact that each day the value and importance of the technical school are becoming better appreciated, and that at this time none are readier to acknowledge the benefits conferred by systematic training in such schools than the leading engineers, who, without such preparation, have by their individual, unaided efforts, risen to deserved prominence and fame. Such general appreciation is recognized in the spoken and written word of the foremost men in the profession, in the fact that they send their sons and advise young men seeking to become mechanical engineers to attend these schools, and in the marked preference shown in the employment of the technically trained engineers. That these are facts is a cause for congratulation, a testimony to the value of systematic study, and an evidence of at least an average efficiency on the part of the leading schools of mechanical engineering. It is a great advance upon the time, not so long ago, when it was presumed that the main thing — and the first thing — the technical graduate had to do was to unlearn almost every thing he had acquired in the schools.

While we should be duly grateful that the status at the present day is such as we have pictured it, we must not conclude hastily that the technical school is fulfilling its entire mission, or, if I may so term it, attaining an efficiency of one. I am well aware that this would be asking too much; for what device, scheme, or appliance can show up this efficiency? At the same time the technical school should approach this limiting value of the perfect device as nearly as possible, and we should study the sources of loss, so as to reduce the losses to a minimum.

Such is naturally the main object of the serious work of alumni meetings, and the president's address should at least serve as an incentive to direct special thought on the part of the membership to these particulars.

From this point of view, the inquiry has suggested itself to me as worthy of our consideration, has the instruction in schools of mechanical engineering, within the past twelve years, progressed so as to conform to the increasing needs called for by the engineering advances secured within the same time?

In a paper read last month before the American Society of Mechanical Engineers, one of the members, who has practically contributed to the progress of the printing-press, presents 'A Plea for the Printing-Press in Mechanical Engineering Schools.' It is an honest plea, courteously uttered, and with an evident desire in no way to disparage the value of the training secured in engineering schools. The writer maintains, that while the printing-press shares, perhaps, alike with the steam-engine the fame as a great civilizer, no attention is given to it in any specific way in the leading engineering schools; that no books relating to it are studied or referred to, no lectures delivered detailing its mechanism; that its factories are not inspected by the students; and that no sample machines adorn the schools' laboratories of engineering. All this is inferred by the writer from a perusal of the catalogues. Usually, judgment as to the course of studies pursued, if based solely on the catalogues themselves, is a dangerous procedure, apt to lead to fatal errors; but in this case no mistake is made, for it is a fact that the printing-press receives but little if any attention in the engineering schools.

Had our friend, the writer, been interested to draw the picture of neglect of subjects discussed still further, he would have soon discovered that small attention, if any, is paid in the course pursued in engineering schools to type setting and distributing machines, paper-making machinery, envelope-machines, sewing and stitching machines, which are allied closely with the printing-press as civilizing agents. And if he looked over the many practical industrial engineering fields, he would have had to come to the conclusion, that, as a whole, but little if any attention is paid to hat-making, cloth-finishing, brick-making, and agricultural machinery, and the like, and that even the looms of various nature come in for the most cursory attention.

Had this been done, the amount of neglect discovered would have been so appalling that he would logically have been forced to one of two conclusions, — either that his point of view and solution were not the proper ones; or that mechanical engineering schools are essentially a failure, and not in one whit entitled to the credit which he really liberally bestows, when having but the one practical omission in mind, and not the many others, no less important ones, only a few of which we have enumerated.

Had the latter conclusion, condemning the schools as a failure, been reached, it would, in my judgment, have been a totally erroneous one.

Still the fact remains that within the past twelve years (and I only name this period because it is the term in which, since graduating from Stevens, I have followed more closely and played my humble part in the current of events) the progress made in most of the individual engineering and mechanical pursuits has been tremendous, while entirely new industries have called for new engineering appliances, and, *vice versa*, new inventions have developed new industries.

What should be the relation of the course of study pursued in the schools of mechanical engineering to these ever-increasing important industrial engineering applications?

Should every new, important mechanical device, especially if it brings with it new fields of practical employment and labor for the engineer, immediately find its place as a study in the engineering school?

If this be so, the school of mechanical engineering will have to extend its term of study to an indefinite extent; and ere long it will come to pass that the young student, entering as a beardless youth, will graduate from the school as a gray-haired man in the decline of life: for, surely, if every important machine is to be the subject of special study in the technical school, a lifetime will only suffice to cover the ground. And the result?

The result would be that the engineering schools would be of no use to the world; for the world's engineering work would be being done by outsiders, while the gray-haired students, plodding along, would be kept busy studying this very work, and not be active agents in its development.

I have purposely drawn this picture from an extreme point of view, for such method often enables us to discover what the fundamental truth underlying the problem really is. I think, in this case, the truth is apparent at once.

It is the mission of the technical school to inculcate the principles of engineering, to train and mature the powers of observation and mechanical judgment, and, after teaching the laws of physics and mechanics, to give the ability to apply these laws to problems arising in machinery and the industrial arts. The special machines and appliances dwelt upon in the school should serve this one purpose: a knowledge of them should not be the end, but the means. Because we can best inculcate and supplement a correct understanding of the physical laws, and a knowledge of how to apply them to the design of machinery, by studying the successful applications made, therefore such study should form an important factor in the course of the technical school.

These engines, motors, machines, factories, and engineering works should serve as the constant tests and checks of the student's efforts at individual design. When the student has once acquired the ability to put physical principles and experimental data

[1] Presidential address delivered by Alfred R. Wolff, M.E., before the Alumni Association of the Stevens Institute of Technology, June 13, 1888.

into the best engineering forms, bearing in mind economy of material, with least sacrifice of strength, best method of handling, management, and the like, he comes equipped to struggle with new machines of which he has had no previous special knowledge. The school cannot give to the student all this desirable latent power, or stored energy, for much of it must come in later life from individual, unaided effort; and the experiences of daily application (often coupled with some degree of failure) must be the teachers which never leave the side of the devotee of engineering science. But these teachers are most efficient, if the student has been trained in the engineering school both and ever to reason before beginning work, and to check his previous reasoning by the results secured.

If we regard the technical school from this aspect, it is plain why the various prime movers play so important an element in the course of instruction, to the disadvantage of other possibly equally important machines.

They are the most direct applications of very important and leading laws of physics; and the intelligent discussion of the prime movers calls for quite a knowledge of these laws, both in experimental and mathematical form. The problems of mechanics are splendidly embodied in the design of the various parts, and in many diverse ways, modified as is the application by the strains to which the parts are submitted, the strength of the materials, and the practical methods of their working. Every conceivable strain, simple and compound, since it enters the working of the steam-engine, for instance, comes up for consideration, while all the leading materials enter its construction. The prime movers act as fine checks on the student's individual efforts at design, for they represent the embodiment of centuries of application and development by the best engineering talent. They give opportunity for experimental verification of the laws of physics and mechanics as well.

In other words, I maintain that the main reason why the prime movers play so important a factor, and occupy so leading a part, in the course of study of a technical school, is not directly because they are such great civilizing agents and have so wide an application, but because they serve, as above indicated, as the best method of study for the incipient engineer. I do not think that the latter point has been sufficiently analyzed, emphasized, and made clear, certain as I am that you will agree with me as to its importance and truth.

And it is for the same reason that other far-reaching machinery, such as I have mentioned, great as is its use, and important as is its development, can have but little time devoted to its study in the technical school. It is because, as engineering exercises, these machines do not equal the prime movers; and saving of time commands that the best exercises be adopted. If the prime movers were far less important industrial factors than they really are, their study would, in a well-regulated course of engineering, which is planned not as an advertising medium, but is based on the principle of serving the student best, be just as important a matter and as conspicuous as is the case to-day. I think the point of view that the machinery discussed in the schools should be the educational means, should be the exercises adopted for testing and furthering a knowledge of the laws of physics and mechanics, as embodied in design, is an efficient answer to much of the criticism of the class to which we have referred.

If it be insisted on, that the reason so much time is devoted to the prime movers (notably steam-engines) is because of their general application in all industries, I will admit that this may have been the cause why originally they were put down for so much attention. Had it then, however, not been shown that they serve as well as the best exercises in the application of the laws of physics, mechanics, and design, they could not have held their place, and would, long ere this, have had to give way to the study of other devices of less wide application which answered the educational need better.

I fully appreciate the view that it is commendable, indeed desirable, that the students, when graduating from technical schools, should possess some general knowledge of the leading machines in the market; but the first essential thing is, that they should have acquired the ability to be useful workers in every field by being possessed of a knowledge of the principles and methods of procedure which underlies all engineering works and machines and their design.

At the same time let us not be slow to learn all we can from criticism honestly advanced; and so, while I do not deem it an essential matter, I say (cost, room, and time permitting) it were well, perhaps, if some few important machines, now totally neglected, could find some place as types in the engineering laboratories, and receive some brief attention by visits to the factories, or, in some cases, by evening lectures delivered by specialists. To a limited extent this might prove, it appears to me, a proper field for non-resident lectureships. It is indeed a question whether such lectures on special machines not at all studied in the school, delivered by acknowledged experts, would not prove more useful than the growing practice of having matters that are gone over in detail in the regular course reviewed hastily in brief discourse by leading engineers. In the nature of things, these outsiders are apt to be at sea in point of exact information as to the extent of preparation and acquisition of their hearers, the students, in the special subject under discussion, and thus are led to indulge in the dispensation of elementary information or fruitless generalities, which add little or nothing to the students' knowledge or ability.

But, before even this special lecture course is undertaken, we should make sure that any time which can be gained cannot be more advantageously employed in a more thorough course of the prime movers themselves; for to-day it is a common experience and regret, on the part of professors of engineering, that they cannot find in the crowded curriculum much needed leisure to devote to some important educational problems in design and applied engineering which these prime movers offer.

The general view that time is an important factor, that the best attainable must be accomplished within a given time, and those exercises be adopted which will serve as the best means of furthering a knowledge of the principles in their engineering aspect, and, furthermore, the desirability to embrace every thing of real importance in the course, makes it a vital matter to constantly scrutinize and keep close watch on the course pursued, in the hope of discovering whether some matters studied might not be omitted or advantageously modified, so as to give spare time to the essential.

Regarding it from this aspect, it has occurred to me that some of the theoretical preparatory studies pursued, such as mathematics, physics, chemistry, and the like, — and I purposely omit languages, belles-lettres, and those general academic branches having a less intimate connection with the engineering course, — seem not to be carried out in some particulars so as to secure the highest efficiency from an engineering point of view.

Let me call your attention to this point. Is it not remarkable that essentially the same text-books on physics, chemistry, analytical mathematics, descriptive geometry, and the like, are studied at engineering schools as at the ordinary academic course of a university? Does not this fact of itself almost imply that the studies, as pursued, are not made to specially adapt themselves to the needs of the applied studies of the engineer? Could not some abstract developments, now dwelt upon at length, be advantageously omitted, while physical experiments and applications in heat, electricity, and the like, be more copiously introduced as exercises, both with the view of imparting a thorough hold on the abstract taught, and also as imparting requisite useful information and methods of procedure? It is my opinion, that, in the application of mathematics to physical problems, even the mathematician, and certainly the engineer, can best test and master a knowledge of the mathematics themselves.

How common is the experience of those who, having acquired in the usual way, even from the best of masters, what they considered a pretty fair hold on calculus, — and this embraces the experience of many gifted students, — when they tried to apply this knowledge in the study of the mechanical theory of heat, found they really had no thorough grip on the calculus, as they had presumed, and had, in fact, to start anew, with a decided loss of time, which might, it seems to me, have been avoided!

I concede the value as fully, and am as anxious as any one to guard the pursuit of knowledge in the abstract on its own account. Still, I say, why not in plane, solid, descriptive, and analytical geometry, and in calculus and other analytical mathematics, gain

some time now devoted to the elucidation of abstract propositions, and detailed elaborations in various forms of the same propositions, of no direct value, and some time now devoted to applications, which, designed to test the understanding, are really essentially numerical substitutions, so as to find leisure to supply physical problems as a test? The latter problems best serve to call forth a true knowledge of the principles. It is only in such application that we discover whether we have really grasped and actually secured the full meaning of the principle. So, too, in the course of physics as pursued in mechanical engineering schools, some details now studied, from force of habit and as being the regular thing in a complete course of physics, might, it appears to me, be advantageously omitted, and replaced by special and more extended work in heat, electricity, elasticity, and the like.

Surely, I trust, this will not be misinterpreted as a plea for the abandonment of study of abstract principles. The abstract principle is to be thoroughly studied, and the application is designed to insure the full comprehension of the principle. But why not select as far as possible, and dwell mainly on, such abstract principles, which can be re-enforced by these physical tests, and select such practical physical exercises, experience in which will re-act alike most directly to the comprehension of the abstract, and as desirable preparatory knowledge for the engineering course?

This is the only solution, if a four-years' course is to suffice; and, furthermore, it is in direct accord with the principle which underlies the engineering instruction, and which permits us to pay little attention to many fine important engineering devices, such as the printing-presses, agricultural machinery, and the like.

You will readily appreciate that this insertion of proper exercises, this working-out of special text-books and courses of study in the various elementary sciences, forming the foundation and most of the first two years' course of the mechanical engineer, applies to the several branches taught. I cannot burden this already too long address with details in the several departments; but there is, it appears to me, no great difficulty in discovering them when careful search is made.

If the point here emphasized would be borne in mind more steadfastly than is now the case, I believe time could be saved in the two later years, when the deficiency outlined must be then supplied as best it can, and some further exercises bearing on useful applications in design, and special lectures now crowded out, could find room.

If I have dwelt on the time available as an important factor in the educational problem, it is not to be interpreted as a favoring of undue haste. Better acquire some things thoroughly than a greater number superficially, for only in thorough acquirement can habits of correct observation and matured judgment be formed.

If I pointed out that in the two years' preparatory work of the course in an engineering school the general scheme seems to me, as far as I have been able to follow the matter, to be essentially the same during the past twelve years, while the fact of the rapid developments in applied engineering does make it important to consider some matters, at least from a general point of view, not necessary to consider at all twelve years ago, it is not to be construed as a sweeping criticism of this preparatory course. Such course is in my opinion, on the whole, admirable, but I believe it could be improved in the particular named. At the same time I am aware that a practising engineer, who only gives thought to these educational matters now and then, is apt to underrate the progress made; which progress may, in fact, be much greater than he anticipates, and perhaps even in the very line of the criticism advanced. If it be thus, so much the better that these words be uttered at the alumni meeting of the leading school of mechanical engineering in the country, where the presence of the faculty and their participation in the discussion will speedily lead to rectification of the error, if such it be, and to the enlightenment of those graduates and others who share the views just set forth.

In closing, let me emphasize that what I have said is meant to apply not specifically to our own alma mater, but to mechanical engineering schools in general.

The conferring of degrees at the close of the twelfth academic year of the Johns Hopkins University took place June 14.

THE ETHNIC POSITION OF THE BASQUE NATION.

The Basque or Euskarian people of the Pyrenæan and Cantabrian ridge are supposed to count at present about six hundred thousand souls. Four-fifths of them live on Spanish territory. They are well-proportioned in their bodies, but rather small, so that a large percentage have to be excluded from military service. Most of them are of a dark-brown complexion, although blondes are not scarce. Their faces are oval, their features agreeable, their general health excellent; and "to run like a Basque" has become a proverbial locution throughout the south-west of Europe. Among the Spanish Basques the dolichocephalic type is almost the only one observed. These and other ethnologic points form the introductory to a learned article by Prof. G. Gerland, 'The Basques and the Iberians,' inserted in the first volume of G. Gröber's 'Grundriss der romanischen Philologie,' one of the best encyclopedic works that ever appeared on the Romance languages of southern Europe (1886, pp. 313–334). The peculiar social and legal customs of the Basques, our author continues, make of them a people with archaistic survivals of various kinds, but do not by any means prove them to be an ethnologically isolated race. But their peculiar language shows them to be distinct from any other nationality. Some said that the 'Vascuence' was the language spoken in Paradise, while others believed "that even the Devil could not acquire this tongue." The sound *f* is wanting in all its dialects, and the language belongs to the agglutinative type. The radices are all monosyllables, or reducible to such, verbal roots being made clearly distinct from nominal roots. Basque is a pure suffix language, prefixes being unknown: even the definite article 'a' is postpositive. The language is not sex-denoting, except in the pronoun. The inflection of the transitive verb differs from that of the intransitive, but in both is mainly carried on by auxiliary verbs. The large number of verbal conjugations established by the earlier grammarians chiefly rest on the various direct and indirect pronominal objects that may become connected with the verb.

All these distinguishing traits of the language separate the Basque from the Celts as well as from the Romans; but whether they separated them also from the old Iberians is the problem which Gerland (and so many others before him) has tried to solve. The reports of the ancients upon the popular customs of the Iberians wholly coincide with what we know of the Basques of to-day; but a much more stringent proof lies in the fact that the ancient local names of the largest portion of Hispania, then inhabited by the Iberians, can be explained through the Basque language only. This region of Basque local names also extended over Aquitania in south-western France; and it is a striking fact in favor of this theory, that the present Gasconian dialect does not know the sounds *f* and *v*, for the Gascons are nothing else but Romanized Basques, and the tribal name of the ancient Ausci in those parts is the radix of the name 'Euskarian.'

That the Iberians, or ancient Basques as we may call them with Gerland, formed a unit as to their language and ethnic peculiarities, is evidenced by the fact that the Spanish language was evolved in homogeneous, uniform manner throughout the peninsula, whereas in France and Italy the ethnic difference of the inhabitants has produced dialects in the north and south which are opposed to each other, just as so many different languages. Although an immigration of Celts about 530 B.C. produced a race called Celtiberians, the manners and customs have remained Iberian with small modifications, and the dialectic differences among these were probably inconsiderable. Among the Iberian features which have impressed themselves upon the Spanish people, Gerland counts the bigotry and fanaticism of the Church, and the fondness for audacious, adventurous maritime expeditions.

While enumerating Basque terms which have found their way into the Spanish literary language, Gerland very pertinently remarks that barely one-third of these is found in the Portuguese, but that several had entered into the Hispano-Roman dialect at the time of the Roman domination. The Latin tongue has undergone less alterations in the Spanish language than in any other of the Romance languages of modern times. This is explained by Gerland by the fact that the Basque then spoken in the country was too heterogeneous for having much influence on the phonetics and morphology of the new language then in course of formation. The

late Prof. Fr. Dïez was of different opinion. He thought that Italian was that Romance language which formed the nearest approach to Old Latin. But there is no doubt that Spanish and Portuguese show considerable repugnance against the sound *f*, and that the double pronunciation of *r* in Spanish and Portuguese is identical with the one we find in Basque. Gerland also proposes the query, whether the softened *l*, *ñ*, *n*, so frequent in Basque, have caused the softening of *l* and *n* into *ll* and *ñ* of Spanish as well as of Portuguese, or whether this must be ascribed to other causes.

THE GREAT MARCH BLIZZARD.

THE great storm off the Atlantic coast of the United States of March 11–14 will probably go into history as the most severe experienced since this country has been inhabited by Europeans. Not only was it remarkable for its force and duration, but also for the unexpected manner of its appearance and development, and for the track it followed from the time it was first observed to that of its final disappearance.

No previous great storm at sea has been as thoroughly studied from such abundance of data as this very fortunately has been. From the time that the first vessel arrived in port which had encountered the storm at sea, to the present, the Hydrographic Office of the Navy Department has been collecting, arranging, and comparing all the reports in regard to it that have been received, and will soon publish a monograph giving a history of the great disturbance, illustrated by a number of carefully prepared maps and charts. Mr. Everett Hayden, who has had charge of the work, in a paper recently read before the National Geographic Society, gave the substance of what this monograph will contain. The following is an abstract of his paper.

Mr. Hayden began by referring briefly to the difficulties and delays that necessarily attend the collection of data by which to study the character and progress of a great ocean-storm, and illustrated these by stating the fact that a ship which recently arrived at New York from Calcutta supplied very valuable facts regarding one of the great hurricanes of August last, from a region to the westward of the Cape Verde Islands, where data were especially needed.

Four large colored charts were used to illustrate the meteorological conditions over the area charted (latitude 25° to 5° north, longitude 50° to 85° west) at 7 A.M., 75th meridian time, March 11, 12, 13, and 14 respectively. These charts contained isobars for each tenth of an inch, reduced pressure, and isotherms for each 10° F.; temperatures above freezing, in a tint of varying intensity of red; and below freezing, of blue. A large track-chart with vessels' positions and tracks enabled the audience more clearly to follow the discussion and the storm-reports which were quoted. A barometer diagram illustrated the fluctuations of the barometer at six land-stations and on board six vessels, selected with special reference to the completeness of their data, and their position relative to the storm. Diagrams were prepared, also, to show the varying height of the barometer along north-and-south sections, selected to emphasize the fact that the special feature of the storm was its trough-like form, the isobars about the area of low barometer being elliptical in shape, along a north-and-south line, and moving eastward between two ridges of high barometer.

The synchronous weather-charts were discussed successively. The first, that for 7 A.M., March 11, showed a trough of low barometer reaching from the Gulf far northward, past the eastern shore of Lake Huron, toward the southern limits of Hudson Bay. Off the coast a ridge of high barometer stretched down from the Gulf of St. Lawrence toward Santo Domingo, passing about midway between the Bermudas and Cape Hatteras. To the westward another ridge of high barometer extended from Dakota to below the Rio Grande. Along the coast the prevailing winds were therefore easterly and south-westerly; the warm, moist air drawn up from down within the tropics causing a warm wave, with generally cloudy weather and rain. In rear of the line of low barometer, a cold, north-westerly wind was blowing, carrying a cold wave far down into the Gulf, with frosts as far south as Louisiana and Mississippi, and cool northerly winds clear down to Vera Cruz.

Before considering the next chart, a description was given of the meteorological conditions off the coast, awaiting the advance of this long line of cold north-westerly gales, which was moving eastward at the rate of about six hundred miles a day. Attention was also called to the importance of considering, in this connection, the vitally important influence of the great warm ocean-current, the Gulf Stream, in increasing the energy of storms when they reach the coast. By way of more vividly illustrating the energy of action developed when cold winds blow over it, mention was made of the many water-spouts reported off the coast the last few months, and a few of those reports were quoted. It was shown, also, that the surface temperature in the axis of the Gulf Stream off Hatteras was as high as 76°, while that of the cold inshore current was fully 30° lower.

The storm was then followed as it approached the coast, its energy increasing every hour, and the barometric depression deepening. At 3 P.M., one centre, with pressure as low as 29.7, had just passed the coast south of Hatteras; while another, with pressure quite as low, or lower, was central over the Province of Ontario. Although the general trough-like form of the storm remained, as clearly indicated by reports from vessels all along the coast, yet another secondary storm-centre, and one of very great energy, formed offshore, north of Hatteras, as soon as the line had passed the coast. It was this centre, in violence fully equal to a tropical hurricane, and rendered still more dangerous by the freezing weather and blinding snow, which raged with such fury off Sandy Hook and Block Island for two days, — days likely to be long memorable along the coast. Its long continuance was probably due to the retardation of the centre of the line in its eastward motion, by the areas of high barometer about Newfoundland; so that this storm-centre delayed between Block Island and Nantucket, while the northern and southern flanks of the line swung around to the eastward, the advance of the lower one gradually cutting off the supply of warm, moist air rushing up from lower latitudes into contact with the cold north-westerly gale sweeping down from off the coast between Hatteras and Nantucket.

So far as the ocean is concerned, the night of the 11th–12th saw the great storm at its maximum, and its great extent and terrific violence make it to be one of the most severe ever experienced off our coast. Only a few corrected barometric readings were lower than 29, and the lowest pressure was probably not lower than 28.9, although lower readings were observed a few days later off the Grand Banks.

The chart for 7 A.M., March 12, showed the line or trough with isobars closely crowded together southward of Block Island, but still of a general elliptical shape, the lower portion of the line swinging eastward toward Bermuda, and carrying with it violent squalls of snow and hail far below the 35th parallel. The high land of Cuba and Santo Domingo prevented its effects from reaching the Caribbean Sea, although it was distinctly noticed by a vessel south of Cape Maysi, in the Windward Channel. The isotherm of 33° reached from central Georgia to the coast below Norfolk, and thence out into the Atlantic to a point about one hundred miles south of Block Island. Farther north, it ran inshore of Cape Cod, explaining the fact that so little snow, comparatively, fell in Rhode Island and south-eastern Massachusetts.

By next morning the storm was beginning to decrease in severity; and the chart shows that westerly winds and low temperatures had spread over a wide tract of ocean below the 40th parallel, while over the ocean north of that parallel the prevailing winds were easterly. The lower storm-centre was now in about latitude 40° north, longitude 39° west, with a pressure of 29.30; and the other a little distance south of a line from Nantucket to Block Island, barometer 29, the isobars extending in a general easterly and westerly direction. The delay of the storm off the coast, and its rapid increase of energy, had been shown in the most marked manner by the fluctuations of the barometer at land-stations and aboard vessels, and the barometer diagram was referred to by way of illustration.

March 14 the storm off Block Island had almost died away, with light variable winds and occasional snow-squalls; the other centre was about two hundred miles south-east from Sable Island. The great wave of low barometer had overspread the entire western portion of the North Atlantic, with unsettled, squally weather from Labrador to the Windward Islands. The area of high pressure in

advance had moved eastward, to be felt over the British Isles from the 17th to the 21st of the month, and after it a rapid fall of the barometer. The isotherm of 32° reached from the southern coast of North Carolina well offshore, thence northward to the coast of Maine, and from central Maine eastward across Cape Breton Island and southern Newfoundland. From the south-eastern to the north-western portion of the chart, the shades of color showed a difference of temperature of more than 80° (from above 70° to below −10°); but such great differences of temperature and pressure could not last long, and the normal conditions were gradually restored.

ELECTRICAL SCIENCE.

Atmospheric Electricity.

THE *London Electrician* contains an abstract of a paper by Prof. L. Weber which is of interest. He erected two insulated conductors on the top of the Riesengebirge; but he says, that, curiously enough, since they have been put up, they have never been struck by lightning, although before their erection lightning-flashes were continually occurring. He also made some kite and balloon experiments, in connection with which he goes at considerable length into the question of the effect of the conducting-string in altering the electrical condition of the circumjacent air layers, and also considers the effects due to a long conductor completely insulated from the earth, and without discharging-points; a similar conductor, with slight power of discharge along its whole length; an insulated conductor, with strong discharge-power (e.g., a flame) at the upper end; and other similar and more complicated cases. His kite-string was really a steel wire. The discharge-points of the kite consisted of 400 needle-points. In other cases he had the tails of the kite made of silver paper for the same purpose. The potential was measured by the length of sparks; the current, with a galvanometer. The latter varied in general from .07 to 2.5 micro-ampères. The potential varied generally from 3,000 to 10,000 volts. When thick clouds were overhead, there were no appreciable sparks, the strongest sparks being obtained when the zenith was either quite clear, or when cumulo-stratus clouds appeared. With potentials of 11,000 and 20,000 volts, currents of 4 and 8 micro-ampères were obtained.

INCANDESCENT LAMPS WITH ALTERNATING AND DIRECT CURRENTS. — Professors Ayrton and Perry have carried on a series of experiments to determine whether the efficiency of incandescent electric lamps is the same when supplied with alternating currents and with direct currents. The following table gives the results of measurements on four different lamps: —

Lamp.	No. of Experiments made.	Watts per Candle. *White Light.*			
		Continuous.		Alternating.	
1	20	3.053		3.033	
		Green Light.		*Red Light.*	
		Continuous.	Alt.	Continuous.	Alt.
2	19	2.597	2.534	3.100	3.100
3	20	2.935	2.966	3.254	3.164
4	16	2.900	3.073	3.504	3.477
Mean of last three experiments ..		2.811	2.857	3.286	3.247
		Continuous.		Alternating.	
Mean of all results.....		3.049		3.0497	

These results show, that, as far as the economy of the lamp is concerned, the efficiency of the two systems is about the same. What the life of the lamp would be with alternating currents is a matter which has yet to be decided. Considering the rapidity with which small wires respond in temperature to changes in current, it might be, when the period of the alternating current is not extremely rapid, that the filament of a lamp supplied by such a current would be at times at a much higher temperature than the average, at other times at a lower temperature. If this were the case, we would expect that the life of a lamp supplied in this way would be less than that of the same lamp fed by a continuous current. With 300 reversals a second, however, the temperature would vary but little, and there is no reason that the life of the lamp should not be the same with continuous and alternating currents.

POLARIZATION OF PLATINUM PLATES. — Mr. C. H. Draper has experimented on the electro-motive force of polarization between platinum plates immersed in dilute sulphuric acid, for different strengths of current passing between the plates, and with different temperatures. It is well known, that, if an electric current be sent between such plates, an electro-motive force of polarization is produced, in a direction opposite to that of the impressed electro-motive force, and of a value something in the neighborhood of one and a half volts. Mr. Draper tried to find if this opposing electro-motive force was independent of the current and temperature, and, if not, in what way it varies with them. The conclusions at which he arrives are as follows: 1. The opposing electro-motive force of polarization which arises in cells when at work depends on the value of the current passing through them when that current is below a certain value, increasing, but more and more slowly, with the current; 2. There is a maximum value of the polarization regarded only as a function of the current strength, beyond which any increase in the strength of the current has no effect upon it; 3. The electro-motive force of polarization varies with temperature, its value decreasing about one per cent for a rise of temperature of 4°6.

ELECTRIC MINING ROAD AT LYKENS. — Among the interesting applications of electricity to mining-work, the electric road in the coal-mines at Lykens, Penn., is one of the most successful. It has been pointed out in this journal that electricity offers especial advantages for use at mines where fuel is scarce and water-power of easy access, as in the silver and other mines in our Western territory; but, besides the decreased cost of fuel, the ease with which electric motors can be used in almost any position, under conditions that steam-engines could not meet, makes electric transmission still more valuable. In coal-mines the cost of fuel is, of course, a small item; but the greater safety, efficiency, and flexibility of a system of electrical distribution, as compared with a number of steam-engines, give it an advantage which must soon be recognized. In the Lykens Valley Mines there has been used for some time an electric-motor car to take the place of mules for hauling cars from the mine. The length of the road is 6,300 feet; the weight of the locomotive, 15,000 pounds; the largest load it is capable of handling, 150 tons; the speed, 6 to 8 miles per hour. A second road on the same general plan is being equipped for the same company. The system employed is the Schlesinger.

DESIGNING DYNAMO-ELECTRIC MACHINES. — Until very recently the designing of dynamo-electric machinery was an empirical matter. The practice was to roughly guess, from the dimensions of some similar machine, about what the dimensions should be to give the required output, and, after the dynamo was built, to change the number of revolutions or the winding of the field-magnets until the required conditions were fulfilled. Sometimes even this would not suffice to bring the machine to its output, in which case another was built. In the last two years the papers of Mr. Kapp and Dr. Hopkinson, together with the growing habit of treating a magnetic circuit in the same way that ordinary electric circuits are treated, introducing the idea of magnetic resistance, have greatly increased the certainty with which dynamos may be designed. In fact, from experiments on one machine of a type, we can design another of the same type to give any required output, with considerable accuracy. While this is not generally recognized in this country, it soon will be, and a great deal of expense and energy will be saved; besides which, a consideration of the magnetic resistance of various parts of the magnetic circuit of a dynamo

should improve the designs of machines now being built. The best dimensions to give the different parts of any dynamo is a perfectly definite problem, involving, besides questions of electrical efficiency, questions of the cost of the iron and wire and labor. However, the problem can be solved, and each maker of dynamos should have it solved. In a recent paper, Professors Ayrton and Perry have considered the magnetic circuit of dynamo machines, and have arrived at some important conclusions. Considering the resistance of the magnetic circuit, they find, that, when a machine is working at its best permanent output, its iron magnetic resistance plus the air magnetic resistance of the clearance is equal to the air magnetic resistance of the space on the outside of the armature occupied by the winding. The paper of Professors Ayrton and Perry, with those above mentioned, will greatly aid in the improvement of dynamo-electric machinery.

MENTAL SCIENCE.

The Relative Legibility of the Small Letters.

READING is one of the most widespread of modern activities, and the endless multiplication of books and cheap editions makes a study of the factors of this process of great importance. In the end the process reduces to the differentiation of black or colored marks on a white or colored surface. 'Black on white' is current as an expression for clearness, leaving the question of the shapes of the letters as the important one. Inasmuch as the Roman alphabet is in use for the chief languages of civilization, and a large majority of the characters are formed by the small letters, the investigation of the forms of these letters is naturally the point of prime value. If by any means we can make the reading of these letters an easier task, the improvement, however minute, when multiplied by the number of times the letter is read, will be very great. This is, however, not the only consideration. Tint and quality of paper, length of lines and spaces between them, the size of the letters and their distances from one another, — all affect the legibility. The end to be aimed at is to attain "the greatest legibility to the square inch," with due regard to taste and economy. The solution of this problem has been experimentally attempted by Dr. Javal and by Dr. Cattell, and has recently been again studied with improved apparatus by Mr. E. C. Sanford (*American Journal of Psychology*, May, 1888).

The first method of obtaining an order of legibility of the letters consisted in measuring the distances at which they could just be read. The letters were fastened to the edge of a rotating disk, and were viewed through a square hole of 2 centimetres, in a black screen placed in front of the disk. Test-type letters of a clear bold pattern were used, the short letters being about 1.8 and the long letters about 2.2 millimetres high. The whole apparatus was mounted on runners sloping upwards from the floor at an angle of about fourteen degrees, and could be moved to any distance from the eye by pulling an endless cord.

The first method of these distance-tests consisted in showing the letters at a fixed distance for the whole alphabet, and noting the number of times each letter was rightly and wrongly named, as well as the letters with which it was liable to be confused. Another fixed distance is then chosen, and the test repeated. The result, with five subjects and the letters at distances varying by 10 centimetres from about 1.5 to 3.2 metres, was as follows, the numbers expressing the percentage of cases in which the letters were correctly read: —

m, 90.9	*v*, 71.0	*x*, 63.0	*n*, 46.2
w, 88.1	*k*, 70.9	*a*, 60.8	*e*, 46.2
f, 84.4	*b*, 70.4	*i*, 60.6	*c*, 45.1
p, 84.3	*y*, 70.4	*l*, 58.6	*o*, 44.9
q, 80.9	*h*, 69.9	*u*, 55.2	*z*, 34.1
r, 78.7	*d*, 68.3	*s*, 53.0	
j, 77.6	*g*, 68.2	*t*, 46.5	

These percentages are based on about three hundred answers for each letter, the preferred letter being counted as the only answer in cases of doubt between two or more letters.

From the same record we can obtain an order of the liability of the letters to confusion and the chief causes of confusion. This order is substantially the same as the former, and would be still more closely like it were it founded on precisely the same data. The order, with the letters most likely to be confused with them, as well as the percentages of cases in which the confusion occurred, are given below: —

m with *w*, 52.	*h* with *b*, 51.
w " *v*, 53.	*x* " *n*, 19; *z*, 15.
p " *r*, 44.	*a* " *u*, 16; *n*, 14; *s*, 13.
f " *r*, 37.	*s* " *n*, 14; *cr*, 12.
r " *v*, 22.	*l* " *i*, 39; *j*, 36.
q " *g*, 30.	*u* " *a*, 18; *z*, 12.
j " *l*, 25; *f*, 21.	*i* " *l*, 58.
v " *r*, 33.	*t* " *i*, 40.
y " *p*, 61.	*n* " *a*, 41.
d " *ag*, 22.	*e* " *c*, 40.
g " *r*, 12; *t*, 10.	*z* " *e*, 19; *s*, 17; *a*, 16.
b " *h*, 45.	*c* " *e*, 34; *o*, 23.
k " *x*, 34.	*o* " *c*, 34; *e*, 23.

Mr. Sanford also tested the letters by setting them so far away that they could not be read, and then having the subject slowly draw them near until he could read them; in general, recording both the distance at which the subject would first hazard a guess, and the distance at which he felt confident that he had correctly read the letter. Here differences in eyesight of the subjects tested make average results meaningless, but the order for any one subject agrees fairly well with that obtained by the other test. If the letters be divided into three groups of eight, ten, and eight,— calling those in the first group good, those in the second fair, and in the third poor, — all the orders agree in making *w*, *m*, *q*, good; *b* and *x*, fair; and *z*, *o*, *c*, *s*, *e*, poor: and the balance of the evidence goes to make the good letters, *w*, *m*, *q*, *p*, *v*, *y*, *j*; the ten fair ones, *h*, *r*, *d*, *g*, *k*, *b*, *x*, *l*, *n*, *u*; and the eight poor ones, *a*, *t*, *i*, *z*, *o*, *c*, *s*, and *e*.

By an ingenious apparatus a dark box in which one of the letters was set could be illuminated for a very minute yet accurately measurable time, and the proportion of cases in which each letter could be correctly named when seen for a definite fraction of a second would again measure its relative legibility. The letters were exposed for times varying from .0013 to .004 of a second, and each letter was shown about two hundred times. A table comparable with that for distance is given below: —

m, 82.	*p*, 61.	*h*, 47.	*n*, 34.
w, 73.	*k*, 61.	*r*, 43.	*e*, 33.
d, 67.	*f*, 58.	*x*, 42.	*s*, 27.
q, 66.	*b*, 52.	*t*, 39.	*c*, 26.
v, 63.	*l*, 49.	*o*, 39.	*z*, 23.
y, 62.	*i*, 48.	*u*, 38.	
j, 61.	*g*, 47.	*a*, 35.	

The order of legibility by the two methods agrees very well, and yields the important conclusion that the letters read at the greatest distance are also the letters most rapidly recognized at an ordinary distance. The order for the two methods, as well as that found by Dr. Cattell by a different mode of time-measurements, are: —

Order for time,	*mwdqvyjp*	*kfblighrxt*	*ouanescz*
Order for distance,	*wmqpvyjf*	*hrdgkbxlnu*	*atizocse*
Order for time (Cattell),	*dkmqhbpw*	*uljtvzrofn*	*axyeigcs*

It so happens, that, of the eight letters most fully represented in a full font of type, three (*e*, *a*, *s*) are the very letters that all the tests agree in regarding as the worst, and six (*e*, *a*, *s*, *o*, *i*, *t*) are among those regarded as poor by two of the results.

Among the deductions formed from this study are, that the concentration of differentia is an important aid to clearness, while the lack of it leads to confusion. Thus, *b*, *d*, *p*, *q*, are all made of a straight stem and a loop, and yet are easily distinguished (except that *b* is confused with *h*); while *g* and *a*, though having few points in common with other letters, are confused with several. The group of confusables (*e*, *o*, *c*) should be differentiated, the *c* being left wide open, and some other form, such as the Greek ε, or an E with square corners, substituted for *e*: *u*, *n*, *a*, should be similarly treated; *u*, *a*, *n*, having their openings kept well open, and *a* changed perhaps to an inverted *v*; *s*, too, needs reform, and a shape

like *f* was found to have several advantages. Though not final, these observations show what letters are good, and to a certain extent why they are so; they similarly point out those that need reform, and suggest the direction in which reform should take place, and, quite as important, furnish us with a method of accurately testing the advantages of any system of letters that may be proposed.

One remark should be added. It is, that the legibility of the letter is not altogether an objective factor, but depends on the familiarity of the letters to the person reading them. Just as it has been shown that we are not as likely to name or write one number as another when told to name a number, so the letters are not equally present to our minds; and certain letters will be more often recognized or confused because we more constantly have them in mind. The same process operates against the comparison of a new form of letter with a conventional form; for the new one, not being familiar, is less likely to be recognized because more rarely present to the consciousness of the subject. Similarly, if the subject is informed that a certain letter is no longer to be shown, the very same impression that would have led him to pronounce in favor of the omitted letter will now have a different effect. In the experiments a similar result, due to the omission of a certain letter without the knowledge of the subject, was observed.

NOTES ON HYPNOTISM.[1] — Dr. A. Dichas has made a detailed study of the memory in the hypnotic state, and summarizes his main conclusions somewhat as follows: (1) during the hypnotic sleep the subject remembers the experiences of his waking life as well as of previous hypnoses; (2) in hypnotism there is often an exaltation of the memory, and at times a change in its content, leading to the assumption of a foreign personality; (3) the memory of what has been going on during hypnosis is usually lost, it can often be revived by a simple suggestion, and at times the memory of a suggested hallucination may linger on, and influence the waking condition; (4) the operator can at his will have any of the acts of the hypnotic state remembered or forgotten by making this a part of a suggestion; (5) suggestion seems to be largely explicable as unconscious memory. —— Dr. Cybulski has studied the power of hypnotic subjects to hypnotize themselves. He finds that such subjects strongly imagine for a minute or less that the operator commands them to go to sleep, and the desired result ensues. Furthermore, if the subject, on going to sleep, imagines himself controlled by a certain person, then, even though another sent him to sleep, he will be subject to the former, and not to the operator. These observations show the importance of the subjective element in the process of hypnotism, and indicate the method by which the subject unconsciously takes suggestions and acts upon them. —— Dr. Berkhan has applied hypnotism to the amelioration of the hearing of the deaf. He tested the hearing of nine deaf boys, and, after hypnotizing them, spoke to them and had various noises made before them. The hearing of four of them was found to be improved, and the improvement is reported as still persisting after eighteen months.

HEALTH MATTERS.

Alcoholic Trance.

DR. T. D. CROTHERS of Hartford, Conn., at the recent meeting of the American Medical Association at Cincinnati, read an interesting paper entitled 'Alcoholic Trance: its Medico-Legal Relations.' In discussing this subject he said that the statements of prisoners that they had no memory or recollection of the crime, or the circumstances associated with it, are not often doubtful excuses to avoid punishment. Certain physiological conditions, supported by clinical facts, indicate beyond all question that such statements are often psychological truths.

In somnambulism the person may go about, and do many intricate acts, without consciousness or recollection of them afterwards. In epilepsy distinct periods of unconsciousness occur. Acts unusual and often violent follow, which are never remembered. In mania these memory-blanks are common, and the person is an automaton, acting without any conscious influence of the present. These are familiar illustrations of some unknown pathological and psychological states of the brain, in which memory is suspended or cut off, and the operations of the mind go on without realization of the surroundings or the influence of experience. This is some obscure form of psychological palsy, in which the person has no recollection of his acts during this time.

From the many clinical studies of cases which have been made, the following general conclusions seem to be sustained: —

1. Alcoholic trance is not an unusual condition in inebriety. The victim is literally an automaton, and acts without memory or consciousness of passing events, — a state which may last from a few minutes to several days.

2. It is distinct from epilepsy, hysteria, or any known forms of mania, and is found associated with some unknown condition following alcoholic poisoning, continuously or at intervals.

3. This condition is probably one of brain-exhaustion, followed by a lowering of consciousness till events are no longer clearly remembered; or a suspension of nerve-force in certain directions, closely allied to paralysis of certain brain-functions: hence there are profound disturbances of brain-centres, and impaired and lessened responsibility.

Dr. Crothers has obtained the records of a large number of trance cases, and his paper gives many of these in detail.

One group of trance cases seems never to do any thing outside a natural, accustomed order of every-day life. Thus, a farmer in this state goes on with his regular work. A physician continues to visit patients, and a railroad-conductor attends to all his usual duties, without any memory of these states. A second group of trance cases seems prominent by unusual acts and thoughts. Thus, a banker in this state left his regular work, and went round delivering tracts in the lower parts of the city. A quiet, retiring man became vociferous, bold, and aggressive. A peaceful man was combative, a truthful man untruthful, and a conscientious, religious man was treacherous and sceptical. Later, these events were perfect blanks in their memory. In a third group of trance cases, some unusual line of conduct seems to grow out of the surroundings unexpectedly, or some old buried thought or conception comes to the surface. Thus, a clergyman insists on riding with the engineer on the engine. A sceptical physician takes part in a prayer-meeting. A merchant goes round threatening to kill an old schoolmaster who punished him in boyhood. A wealthy man has a new will written, disposing of his property differently every time.

In the two last groups criminal cases occur most frequently, although some very remarkable instances have been reported under the first group. In a little work entitled 'Alcoholic Somnambulism,' Professor Jerusky of St. Petersburg mentions the case of a chief of police, who was an inebriate, ordering the arrest and execution of two suspected Jews. His orders were carried out in form, but not in reality. A day later he recovered from his trance state, and had no recollection of the past: he had total amnesia of this act. Another case is cited of an officer who ordered a house burned down, on the supposition that its inmates were preparing to destroy his command. Two days later he awoke with no memory of this event, and could give no reason for the act.

In these cases the somnambulistic act was along the line of his usual work, and performed without the slightest consciousness of its nature or consequences.

The criminal trance cases may be divided into two classes, one of which seems to have no history of criminality previous to the commission of the crime. They are inebriates of active neurotic temperament, who have occupied reputable stations in life, and belong to the better classes. All crime is unusual with them, and apparently grows out of the alcoholic poisoning. The second class are the low neurotics and defectives by birth and education. They have a history of irregularities of life and conduct that seems to prepare the way for criminal acts, and probably are more subject to the trance state because of defective heredity.

All these cases in court are unrecognized. A degree of reasonable conduct up to the time of the crime, and after it, is assumed to be evidence of knowledge of the surroundings and consequences of the act. No fact of inebriety, or statement of no recollection, is thought to lessen in any way the responsibility of the act.

Clinical facts indicate that in all cases of inebriety there is a de-

[1] The reader is referred to an exhaustive review of works on hypnotism in the May number of the *American Journal of Psychology*.

fective brain-power and general perversion of healthy activity; also the door is open for many varied nerve-changes and degrees of brain instability, which always give a doubt to the sanity of the victim. The fact of being an inebriate points to an unsound mind, and more or less incapacity to act or think normally.

When the trance state is determined, the actual responsibility, or cognizance of right or wrong, is suspended: the person is a mental waif, without compass or chart. No evidence of premeditation or apparent judgment in his actions can change this fact. Any special act may spring from some impression laid up in the past, which, when conscious reason is withdrawn, takes on form and semblance. The real condition of the mind is always more or less concealed. Where the case is a periodical inebriate, with distinct free intervals of sanity, a possibility of concealed or masked epilepsy should always be considered. Epilepsy is likely to be present, or to follow from some organic tendency or favoring conditions. When this defence of no memory of the act is made, the case should receive a thorough medical study before any conclusion of responsibility can be reached.

The present treatment of inebriates in courts is nothing less than legal barbarism, founded on error and superstition. The oft-repeated statement that "drunkenness is no excuse for crime," assumes a definition of inebriety that has no support from scientific study and the teaching of facts.

Inebriety in all cases must be regarded as a disease, and the patient forced to use the means of recovery. Like the victim of an infectious disease, his personal responsibility is increased, and the community with him are bound to make the treatment a necessity.

The following propositions sum up many of the facts mentioned: —

1. Inebriety must be recognized as a condition of legal irresponsibility to a certain extent, depending on the character and circumstances of the case, and the general mental integrity displayed.

2. All unusual acts or crime committed by inebriates, either in a state of partial coma or alleged amnesia, which come under legal recognition, should receive thorough study by competent physicians before the legal responsibility can be determined.

3. When the trance state is established beyond doubt, he is both legally and practically irresponsible for his acts during this period, and each should be measured by the facts of its individual history.

4. Inebriety is a disease requiring physical means in the treatment. Society demands of the patient that he use diligence to recover; and, so far as he may neglect this, both himself and community are responsible.

5. It is the duty of the State to provide asylums, and encourage private enterprise to furnish the means and appliances for restoration.

6. Lastly, standing on this borderland, and looking back at the monstrous injustice and legal crime that is daily committed in the punishment of inebriates, who are practically insane, I am convinced that the time has come for a revolution of sentiment and practice, in which both the inebriate and the community must be held responsible, not alone for his acts or the consequences of them, but the causes and conditions which have developed in this way; then the victim will be forced to avail himself of every means for prevention, restoration, and recovery.

A NEW MILITARY RATION. — All the garrisons within the limit of the Seventh German Army Corps, we learn from the *Medical Herald*, have now been provided with larger samples of the new article of food which is in future to form the so-called 'iron ration' of the men in the field. It is a peculiar kind of bread, in the shape of small cubes the size of a chocolate-drop, made of fine wheat-bread, strongly spiced, and calculated to keep for a long time. When taken into the mouth, it quickly softens, and is both palatable and nutritious. It is chiefly intended for forced marches, when there is no time for camping and cooking.

WOUNDS OF THE ABDOMEN. — Modern surgery, aided by antisepsis, has enabled surgeons to accomplish results which, twenty-five years ago, would have been deemed impossible. This is in no department more marked than in abdominal surgery. While formerly a wound of the abdomen, either from a gunshot or a stab, was considered almost necessarily fatal, at the present day many lives are saved by an operation, which consists in opening the abdomen, tying every blood-vessel that may have been lacerated, and sewing up any wound which may have been made in the intestines. One of the most difficult parts of the operation consists in finding the intestinal wound. Dr. Senn of Milwaukee proposes to inject per rectum hydrogen-gas, which, he has demonstrated in dogs, finds its way through the entire length of the intestine; and, if an opening exist, the gas will escape, and can be detected.

BOOK-REVIEWS.

Three Introductory Lectures on the Science of Thought. By F. MAX MULLER. Chicago, The Open Court Publ. Co. 12°.

THESE lectures were delivered last year at the Royal Institution in London, and are intended as an introduction to the subject of which they treat, and which the author has dealt with more largely in his work on 'The Science of Thought.' Many writers before Professor Müller had maintained that language is necessary as an instrument of thought, so that we could not think without it; but he goes much further than this, and maintains that language and thought are identical. This means, if taken literally, that the word 'orange,' when I pronounce it, is identical with the idea of an orange which I have in my mind. When stated in this concrete form, the absurdity of the theory is manifest, but Professor Müller endeavors to escape the absurdity by explaining that the word he identifies with the idea is not the word as actually uttered by the voice and heard with the bodily ear, but the word as heard mentally, or in imagination. This, however, does not remove the difficulty; for the word as heard mentally is not a word at all, but only the idea of a word; so that, when stated in this way, the theory means that the idea of a word is identical with the idea of the thing that it stands for.

Such, then, is the absurdity inherent in Professor Müller's theory; nor does he succeed in removing it in any way: on the contrary, he aggravates it by the addition of others. For instance: in his preface he undertakes to tell us how language first arose; and in so doing he gives himself away to start with. According to his theory of thought, we cannot have a concept, or general idea, until we have a word to symbolize it; and he ought, therefore, to account for the origin of language without assuming any concepts whatever. We need not here repeat his whole account of the matter; but he maintains, that, "before we can get a single conceptual word, we have to pass through at least five stages," and the first of these stages is "consciousness of our own repeated acts." Now, this consciousness involves at least four concepts: (1) the concept of an act, since it is not a single act that we are conscious of, but a series of acts; (2) the concept of number, or of many as distinguished from one; (3) the concept of repetition; (4) the concept of causation, since the acts are regarded as our acts, that is, as caused by us. Thus, according to Professor Müller's view of the origin of language, we must have had at least four concepts before we had a single word; and, if this is so, what becomes of the theory that we cannot have concepts without words? As another example of Professor Müller's reasoning, take his remarks about the thinking of animals. Some one had remarked that animals think, to a certain extent at least, and that this proves that thought is not identical with language, to which Professor Müller replies in this curious way: "If we mean by thought that mental function which has its outward sign and embodiment in language, we must say that animals do not think as we think, namely, *in words*. They may think in their own way. . . . But I cannot allow that they think, *if we define thinking by speaking*." A more ludicrous example of reasoning in a circle it would be impossible to find.

Professor Müller's theory is such a one as we often get when a scientific specialist undertakes to deal with the problems of philosophy. Such a man is apt to think that all philosophical problems can be solved by the methods and principles of his science; and the consequence is a great deal of unphilosophical reasoning. Thus, we have had mathematicians who thought that mathematics was the key to philosophy; and in our own time the biologists have put forth similar claims; and now comes Professor Max Müller, maintaining that philosophy is only a problem of language. But

philosophy is broader than any science, broader than all sciences together, and cannot be comprehended under the formulas of any of them.

Bibliographie des Modernen Hypnotismus. Von MAX DESSOIR. Berlin. 8°.

TO realize the great activity in the study of hypnotism now present in all parts of the civilized world, nothing could be more serviceable than this bibliography. There are included no less than eight hundred titles; and these are devoted to the modern, scientific phases of the study alone, excluding references to the history of the topic, as well as the works of those who wrote when the topic was in a pseudo-scientific stage. By this plan seven-eighths of all the writings catalogued fall in the period since 1880. The increase of interest in the topic since 1880 can be read off from the increase of publications year by year. In 1880 there were published 14 works pertinent to this bibliography; in 1881, 9; in 1882, 39; in 1883, 40; in 1884, 78; in 1885, 71; in 1886, 131; in 1887, 205; in 1888 (January to April), 71. The countries in which the activity in hypnotic studies is greatest are likewise indicated by the languages in which the publications are issued: 473 are in French; 102 are in English, of which 40 come from America; 88 in Italian; 69 in German; 22 in Danish; 16 in Spanish: 12 in Russian; 6 in Dutch; 4 in Swedish; 3 in Norwegian; 2 each in Polish and Hungarian; 1 each in Portuguese and Roumanian. The classification of the topics is a very convenient one. We have first the general works (191 in number); then those with a more special medical interest (of which there are 199); next those on magnetism (36), on the physiology of hypnotism (62), on its psychological and pedagogical aspects (85), on its forensic aspects (43); and, finally, sections on telepathy (81), mesmerism (58), and miscellaneous (46). Under each section the titles are arranged by date of issue, and cross-references to other sections are given. There are also references to the numbers treating of the works of the Nancy school, of the Paris school, the question of simulation, of suggestion, of the practice of hypnotism and its theory. No trouble has been spared to make the bibliography convenient; and, to enable the author to maintain its completeness, he requests that books and articles on the topic be sent to him at W. Köthenerstr. 27, Berlin, Germany.

Die Ekstasen des Menschen. Von PAUL MANTEGAZZA. Tr. by Dr. R. Teuscher. Jena. 8°.

LIKE many of his eminent countrymen, such as Lombroso, Morselli Sergi, Buccola, Vignoli, Mantegazza belongs to the psychological school of naturalists, and devotes his main efforts to bringing into the domain of science groups of facts that have hitherto been left to grow wild in the open road of speculation, or have been perversely cultivated at the hands of mercenary pseudo-scientists. His three works treating from various points of view, but with the anthropological, pedagogical, and psychological interests ever uppermost, of the sexual relations of mankind, indicate one phase of his labors, while another is suggested by his work on facial expression. He combines with his scientific interests a deep feeling for nature, both in the phenomena of land and sea and in that more specially inviting subject conveniently termed 'human nature;' and this is brought to the front in his essay on the art of being happy (*Science*, Dec. 9, 1887). Add to this that the author is a wide traveller, a careful reader, and an excellent stylist, and it is not difficult to understand that whatever he writes is likely to be interesting reading. In the present volume this expectation would not be disappointed. Under the head of human ecstasies are here included all those many extremes of emotion that lead to the forgetting of self, and in their extreme forms to a condition closely allied with the phenomena of hypnotism. It is this connection that lends an especial interest to the study of these phenomena, and rescues many apparently incredible and inexplicable narratives, especially in the history of religious devotion, from the scepticism with which they have been regarded. Moreover, as scientific psychology widens its domains more and more, it finds a large class of phenomena capable of only such a lenient and elastic treatment as are the classification and description of diseases. At best one can empirically describe and diagnose, leaving it to the future to gain a clearer insight and to deduce important generalizations. By singling out the ecstasies of mankind as the heading of a chapter in descriptive psychology, Mantegazza has done a real service to that science, which he himself acknowledges is still in its 'prattling' stages.

Rudimentary forms of minor ecstasies are to be found in animals. There are not only love ecstasies, but, as those passionate delights in activity visible in an unchained dog indicate, a motor type of ecstasy; while the admiration of the bower-bird for its work of art, or the self-admiration of the strutting peacock, shows the beginnings of an æsthetic absorption. In man, and more especially in the man of civilization, the forms of ecstasy are many. We see not only ecstatic states brought about by the exercise of normal physiological functions, but even more by extreme devotion to artificially acquired possessions. Under the first head we contemplate the all-absorbing love of a mother for her child leading to deeds of astounding self-sacrifice, and to moments of rapturous adoration; we witness, though more rarely, the devotion of child to parent, remaining as a rule on a more respectful, contemplative stage; we read of the mutual love and devotion of brothers and sisters, of the soul-stirring compact of friend with friend that played so large a *rôle* in the friendship of classic times; we must even add the instances of Platonic love so often decried as impossible, but warmly defended by Mantegazza, to the crowning passion of romantic love, if we are to grasp the broad extent of the ecstatic horizon. The most interesting as well as the most completely described ecstasies are those connected with religion. These are most closely akin to the exaltations of love, and the devotee often calls herself (for women are more prone to this than men) the bride of her Saviour. Mantegazza confines his descriptions to the ecstasies of Christian religionists, though he could have found material in the history of all Oriental religions. St. Theresa is the type of religious ecstatics, and the minute description of her own feelings and passions that she has left form a very interesting psychological document. With her the deepest passion was for a more intimate communion with the divine essence, — a religious contemplation freed from the trammels of a sensuous life. Of such a nature, too, were the ecstasies of Plotinus, by which his philosophic insight was gained. This is the condition that leads to mysticism, and it has been claimed that a similar state of supersensuous, dreamy abstraction follows the taking of certain drugs. In another kind of religious ecstasy the passion for self-denial and self-torture is uppermost. The feeling that every transgression, however slight, must be absolved by inflicting pain, the feeling of unworthiness, of being a sinful being, seizes the soul, and drives the devotee onward to more and more intense tortures, until pain is no longer felt and the body subjugated. Here occur such marvels as the stigmata, or flowing of blood from definite regions of the skin, in the shape of a cross, or from the hands and feet. The same thing has within recent years been witnessed in very sensitive hysterical hypnotic subjects as the result of a suggestion, and thus indicating what an extreme influence nervous states have over normally automatic, involuntary processes. The conditions of cataleptic rigidity, of trance that we now artificially induce, were seen in religious ecstasy, and, according to the beliefs of the time, were converted into cases of possession by evil spirits. Ascéticism, with hallucinations caused by fasting and fatigue, is another fertile cause of religious ecstasy. All these instances deserve careful study from all who would grasp the various forms in which mental phenomena present themselves in nature.

Patriotism may be so supreme a motive in a man's life that it acquires an ecstatic intensity, and in Mazzini our author finds such an ecstatic. We must also condescend to enumerate under the same head all the devotions of men to favorite pets. There are real cases of ecstatic love of a master to his dog, his horse. Here, too, belong all those hobbies and mania (crazes) that, according to their nature, save the mind from *ennui* and inactivity, or blunt the susceptibilities. The miser gloating over his gold, and the book-collector over a musty treasure, are both in a minor form of ecstasy. There remain a large class of high emotional and intellectual ecstasies in which genius finds its sphere. The æsthetic raptures, whether addressed to the beauties of nature or of art, are among the most real and ennobling, because they touch one of the deepest chords of the human soul, and one that has ever responded

to the advance of human culture. The ear, as well as, and even more readily than, the eye, becomes the avenue by which ecstasy is approached; and the wonderful effects of martial strains, or the deeply touching notes of the human voice, have always been among the poet's favorite themes. Ecstasies of thought, of contemplation, are vouchsafed to the few. Kant declared that nothing so filled him with awe as the starry heavens above and the moral law within, thus indicating two approaches to ecstasy. The flights of poetic imagination, creating worlds harmonious and beautiful, are of a kindred nature. The swaying of the masses by the eloquence of a born orator, who forgets himself and his hearers and feels himself inspired for the occasion, is another phase of this same ecstasy. The intoxication of power that so often leads to its abuse, and has given rise to the phrase 'insanity of power,' is again a type of ecstasy. Finally, all those moments of fruitful discovery when the mysteries of nature are glimpsed, a new contribution to human knowledge made, a novel train of thought begun, are moments of creative ecstasy. In every field of human activity there are possibilities of greatness; and all these have a common element, just as the views from all high mountain-peaks present a close similarity. From the study of these ecstasies, we return with a fuller appreciation of their grandeur and their value, with a realization of their dangers when diverted into morbid channels; we realize, too, what a great *rôle* they have played in human history; and they suggest that man cannot be more aptly described than by defining him as an inspirable animal.

NOTES AND NEWS.

D. C. HEATH & CO. will publish shortly a translation of Paolo Mantegazza's 'Testa, a Book for Boys.' It is a companion book to De Amicis' 'Cuore.' The translation will be made under the supervision of Prof. L. D. Ventura of Boston, and of the Sauveur Summer School of Languages. —— Cassell & Co. have nearly ready a second edition of 'Yachts and Yachting.' The original work consisted of four papers, — 'A History of American Yachting,' by Capt. R. F. Coffin; 'The Mayflower and Galatea Races of 1886,' by C. E. Clay; 'American Steam-Yachting,' by E. S. Jaffray; and 'British Yachting,' by C. J. C. McAllister. These papers had one hundred and ten illustrations by F. S. Cozzens, comprising pictures of all the famous yachts of recent times. C. E. Clay has now covered the subject from 1886 to date, and Mr. Cozzens has provided sixteen new cuts. —— The J. B. Lippincott Company have in press 'An Elementary Treatise on Human Anatomy,' by Joseph Leidy; 'A Cyclopædia of Diseases of Children,' by Dr. J. M. Keating; 'Animal Life of the Seashore,' by Angelo Heilprin in the International Scientific Series; and 'A Popular History of Music,' by James E. Matthew, with one hundred and fifty illustrations, consisting of portraits, musical instruments, facsimiles of rare and early musical typography, etc. —— Frederick Warne & Co. have in preparation 'A Pictorial Natural History Library,' in three volumes, which will teach with more than a thousand illustrated pictures the facts that children devour so greedily. —— W. B. Clarke & Co. (successors to Clarke & Carruth), 340 Washington Street, Boston, will publish shortly 'Among the Theologies,' by Hiram Orcutt, LL.D. —— Ginn & Co. have just ready Benjamin Franklin's autobiography, with notes and a continuation of his life, by D. H. Montgomery; 'Topics in Ancient History,' by Miss C. W. Wood of Holyoke Seminary; 'Arabian Nights,' in their series of Classics for Children; 'Cæsar's Army,' a study of the military art of the Romans in the last days of the Republic, by Harry Pratt Judson of the University of Minnesota; 'Descriptive Geometry,' by Linus Faunce of the Massachusetts Institute of Technology; 'Entrance Examination Papers,' compiled by Dr. John S. White of the Berkeley (New York) School; and questions prepared to accompany Fiske-Irving's 'Washington and His Country,' as a help to teachers using this as a text-book of United States history. —— Scribner & Welford have just ready a volume entitled 'Princetoniana — Charles and A. A. Hodge, with Class and Table Talk of Hodge the Younger,' by a Scottish Princetonian, the Rev. C. A. Salmond, which contains a full biography of Rev. Dr. Charles Hodge (1797–1878), and of his son, the Rev. Dr. A. A. Hodge. Excellent portraits of the two professors, as well as one of Dr. McCosh, contribute to the attraction of this volume. They have also just ready a volume on 'Tropical Africa,' by Henry Drummond, who gives a remarkably interesting account of his recent travels in Central Africa, with one or two chapters of natural history, and notes regarding the latest phases of the slave-trade and African politics generally. They will shortly issue 'The Letters of Frederica Sophia Wilhelmine, Margravine of Baireuth, and Voltaire.' —— Harper & Brothers published on the 15th inst. 'Stepniak's' last book, 'The Russian Peasantry,' for which it is claimed that it is the most instructive and interesting work that has been produced by this remarkable writer, and is written evidently with self-restraint. They will soon issue in book form the practical house-keeping articles which have been contributed to *Harper's Bazar* by Christine Terhune Herrick, a daughter of Marion Harland. —— *The Chautauquan* for July gives the location of forty-three summer assemblies modelled after the original one at Chautauqua, N.Y., and an outline of the work done in each. Of these assemblies, forty-one are located in twenty-one different States and Territories of the United States, one is in Canada, and one in England. The sessions vary in length from three days to two months. —— In John Bogart's article on 'Railway Engineering Feats,' in the July *Scribner's*, will be a full account of life in a pneumatic caisson, far below the surface of the water, during the construction of bridge foundations.

— *Nature* states that the following were elected foreign members of the Royal Society on Thursday, May 31: Prof. Edmund Becquerel of Paris, distinguished for his researches on the effects of light on bodies, especially with reference to phosphorescence; Prof. Hermann Kopp of Heidelberg, for his researches on atomic volumes and boiling-points; Prof. Eduard F. W. Pflüger of Bonn, for his researches in physiology, especially in relation to irritability of nerves, respiration, and animal heat; and Prof. Julius Sachs of Würzburg, for his researches in botany, especially vegetable physiology.

— A despatch from Brussels dated June 18 states that the Kongo officials here think that the report received from a messenger from the Aruvimi was due to confusion regarding Ward's journey. Still they are anxious as to Stanley's fate, chiefly because Emin Bey had heard nothing of Ward, and had received almost positive confirmation of the hostility of tribes between the Aruvimi and Wadelai from officers who had journeyed there. Several Belgian explorers offer to go in search of Stanley, but only by the Kongo route and with a caravan of at most twenty men.

— The House Committee on Appropriations proposes to reduce the field force of the Coast and Geodetic Survey from sixty-two to fifty-eight men.

— The commissioner of fish and fisheries has asked for an appropriation of thirteen thousand dollars for the establishment and maintenance of a fish-cultural station, under the United States Fish Commission, in the Ozark region in south-western Missouri. The commissioner says that the neighborhood of Neosho, Newton County, Mo., affords favorable conditions for the establishment of such a station.

— Mr. William Walter Phelps has introduced into Congress a bill to purchase from Stephen Vail of Morristown, N.J., the original telegraphic instrument, or recording receiver, invented by his father, Alfred Vail, and used upon the first telegraphic line ever constructed, — that between Washington and Baltimore, — and to transmit the first message ever sent: "What hath God wrought?" The purchase of this instrument is strongly recommended by the officers of the Smithsonian Institution. The price is ten thousand dollars.

— In *Science* of March 26, 1886, our Vienna correspondent referred to the then newly invented gas-lamp of Dr. Auer of Welsbach, Austria. The principle of Dr. Auer's lamp is no new one. Every one knows the Drummond light, in which a cylinder of lime is brought to incandescence by a burning mixture of hydrogen and oxygen. But all lights of that character have failed to come into commercial use, because the material to be acted on by the heat has always been present in considerable mass, and has required gas under pressure and a very high temperature to bring the mass

to incandescence. In the Welsbach light, now on exhibition in New York, the incandescent substance is used in an extremely thin or attenuated form, requiring the minimum heat to produce the maximum of light. The principle of the invention will be understood when it is described as a hood or mantle of finely divided but perfectly coherent refractory oxides of lanthanum, zirconium, and yttrium round the flame of a Bunsen burner. The lamp has given satisfactory results so far.

— We learn from the *Engineering and Mining Journal* that the Alliance Aluminium Company has been formed in London, England, with a capital of £500,000, for the purpose of manufacturing aluminium, sodium, and potassium. The company owns the English, German, French, and Belgian patents of Professor Netto for the reduction of aluminium from its compounds, and for the manufacture of sodium and potassium; the processes of Mr. Cunningham for the reduction of the above metals; a process for the manufacture of artificial cryolite by the regeneration of its slags, provisionally protected by the inventor, Mr. Forster, Lonesome Chemical Works, Streatham; a process invented by Professor Netto and Dr. Saloman, of Essen, Germany, by which this metal can be raised to the highest standards of purity on a commercial scale. Exhaustive experiments have been made at the works of Krupp at Essen to test the practical value of the processes, and it is stated that he has the means of making the metal in tons. Instead of beads or marbles, solid chunks of the purest aluminium known, weighing from five pounds to one hundred pounds (according to the size of the converter), are deposited at every fusion of the ingredients, chief among which are sodium and cryolite. The company has a contract with the owners of the cryolite-mines in Greenland to supply it with practically the entire output. It is stated that the patents of the company enable it to manufacture it at considerably less than one shilling per pound.

— An interesting fact in the history of the movement for industrial training in the public schools of Washington is its connection with Cooper Union, that unique institution of which New York is so justly proud. As already stated in *Science*, industrial drawing, including moulding in clay, and construction in card-board, etc., has long been a feature of the Washington schools. The supervisor of drawing, Mrs. S. E. W. Fuller, who for fifteen years has guided the work, was trained in the Cooper Union in those early days when, with an enthusiasm and thoroughness not excelled by later institutions and a wise prevision of coming demands, it brought art and industry into their proper relation as means and purposes of education.

LETTERS TO THE EDITOR.

*** Correspondents are requested to be as brief as possible. The writer's name is in all cases required as proof of good faith.*

Twenty copies of the number containing his communication will be furnished free to any correspondent on request.

The editor will be glad to publish any queries consonant with the character of the journal.

An Unusual Auroral Bow.

I WAS much interested in Mr. D. S. Kellicott's communication in your issue of June 1, describing a peculiar form of northern lights; particularly so, as it was my fortune to witness a similar phenomenon in 1881. On July 2 of that year, the day on which President Garfield was shot, at about 9.20 in the evening, faint streaks of light were observed on the northern horizon. I then observed a streak of cloud-like light ascending at about the east-south-east horizon. Looking around, I saw a similar streak at an opposite point. In a short time these streaks blended into one in the zenith, forming an arch overhead. There was a bend or crook in this arch; just at what point I do not remember, as I made no note of it, but I think at or near the middle. Presently the streak began to grow narrower; then it changed and broadened again, until it became wider than it was at first; then the southern edge resolved itself into parallel bars at right angles with the arch; shortly after, the northern edge resolved itself into similar bars, which moved rapidly towards the west; presently the bars at the southern edge of the arch either vanished or blended with the others, and they all glided swiftly by towards the west; the bars gradually became fewer and fewer, until they could be seen only here and there gliding along; and at last the whole arch faded entirely away. During all this time the lights in the north had been shining, and when I retired for the night they were still to be seen.

I have copied this description from notes which I took at the time. I have seen other interesting auroras, but never have seen the arch overhead since. FRANCIS H. ALLEN.

West Roxbury, Mass, June 13.

Concerning the Montville Serpentine.

THE statement made by your correspondent in your issue of June 15, regarding work done by me on the Montville, N.J., serpentine, induces me to add a few additional particulars on the subject. This I am the more inclined to do, since the paper giving the full results of my work is as yet unpublished, but is awaiting its turn in the Government Printing-Office.

The origin of serpentinous rocks, by a process of metasomatosis, from the various members of the pyroxene group, is a matter by no means new to petrographers in general, and has been noted by Dana in the limestone-beds of Westchester County, N.Y., as well as by Emmons and Cross in those of the Leadville region. None of the cases, however, can compare in point of beauty with that at Montville. Here, in a coarsely crystalline, highly magnesian limestone, were originally embedded numerous large and small spheroidal and lenticular masses of a gray or pure white monoclinic pyroxene approaching diopside in composition. These, through a process of metasomatosis commencing on the outer surface, have become converted wholly or in part into a very pure, though highly hydrated, translucent green and light amber-yellow serpentine. In the process of quarrying the limestone for flux, these nodules are thrown out; and from the quarry dump have been gathered samples showing most beautifully every stage of the change, from that in which the serpentine exists as merely a thin coating, to that in which all traces of the diopside have disappeared, and a solid block of compact serpentine alone remains. The nodules vary in size from the fraction of an inch to two or more feet in diameter. I have as yet, however, never seen blocks of the serpentine more than six or eight inches in greatest diameter. The process of change must have been exceedingly slow and gradual, as the line of demarcation is very sharp; so sharp, indeed, that at first glance such an origin as I have attributed appears impossible. On exposure to the weather, the serpentinous coating undergoes a shrinkage, and breaks away from the unchanged nodule almost as clean as the burr from a chestnut. Nodules in the museum collections, which have been freed from their serpentinous coating, have the appearance of some easily soluble substance, like limestone, that has been suspended freely in a dilute acid until all its angles and irregularities of surface have disappeared.

In my paper which is shortly to appear in the Proceedings of the United States National Museum are plates showing the nodules and the transition stages from diopside to serpentine, as shown in thin sections under the microscope. I have gone into considerable detail in my description, not merely on account of the beauty of the resultant serpentine, but because this is an unusually fine illustration of the process of metasomatosis. The beautifully slickensided surfaces, and other indications of the expansive force generated during the process, are also very suggestive.

The readiness with which samples can be procured which show in a single small specimen all stages, from perfectly fresh and unchanged diopside to beautiful compact serpentine, makes the material particularly valuable to teachers. The small size of the serpentine blocks obtainable, together with the invariably fractured condition of the mineral, renders it of practically no importance as an ornamental stone. GEORGE P. MERRILL.

U.S. Nat. Mus., Washington, June 16.

Queries.

33. DIPHTHERIA CARRIED BY TURKEYS. — Referring to the paragraph 'Diphtheria carried by Turkeys,' in *Science* for May 11, I beg to inquire if the disease among barnyard fowls known as 'roup' has been investigated as a germ disease, and its relations with other animal orders (if it have any) made out or sought.

J. T. W.